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# Improved Model for Gas Migration Velocity of Stagnant non-Newtonian Fluids in Annulus

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## Abstract

Currently, analysis of the Sustained Casing Pressure (SCP) tests or other gas migration problems in the wellbore is limited because the mathematical models employed by most researchers are based on Newtonian fluids, which is not consistent with the actual situation that the mud is non-Newtonian fluid in the Annulus. To ensure the operators a realistic and accurate diagnostic test, the improvement of current gas-migration models is of great significance. In this study, a new model of gas migration in non-Newtonian power law fluids was established. This new model incorporates the correlation between swarm bubbles velocity and drag coefficient, and combines the petroleum correlations and the drift-flux model to determine the friction pressure gradient. In addition, the gas slip velocity in non-Newtonian power law fluids is rigorously determined by the proposed calculation procedure using an iteration approach. Furthermore, improvements of the new model are analyzed and discussed in details. During the process of the hypothetical parameters determination (Initial gas chamber length, initial gas concentration in liquid column, mud compressibility, cement permeability, and formation pressure) for simulation, the same values of parameters with previous study are tried to be utilized to minimize the difference. Results in this work indicate that the big discrepancy of matched parameters between the new model and previous model are generated from the mud compressibility, which is attributed to the gas holdup. The higher gas holdup obtained from the new model manifest the validity of proposed model, which is caused by the higher viscosity of non-Newtonian power law

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